



Diversity of small non-volant mammals of Lita, northwestern Imbabura, Ecuador

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Abstract

The subtropical forests of the Pacific slope of Ecuador lie within a region of wide biodiversity due to the biogeographic influence of Chocó. However, the diversity of small non-volant mammals in these forests is poorly understood. We conducted surveys at seven localities in 2020 and 2021 in Lita, northwestern Imbabura province, Ecuador. Sampling was done on an altitudinal range of 1,314–1,812 m. We used a combination of techniques (Sherman, Tomahawk, and pitfall traps) to capture non-volant small mammals. Our accumulated trapping effort was 2,724 trap/nights. We recorded 180 individuals of 23 species, of which rodents were the most diverse with 17 species, representing 73.9% of the composition. The record of *Pattonimus musseri* Brito et al. (2020) stands out, representing both latitudinal and elevational altitudinal range extensions. Finally, our results indicate that Lita is a natural area with a high concentration of non-volant mammals in the northwestern Ecuadorian subtropics.

Keywords

Cricetidae, *Pattonimus musseri*, subtropical forest

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Introduction

The subtropical forests of northwestern Ecuador have both high biodiversity and endemism due to the biogeographic influence of the Chocó and the Andes Mountains (Simpson 1980; Mittermeier et al. 1999; Myers et al. 2000). For example, a variety of oryzomyines of the genera *Sigmodontomys*, *Tanyuromys*, *Transandinomys*, and “*Handleyomys*” (Pine et al. 2012) are endemic to the forests of Chocó. Despite this, our knowledge of the sigmodontine biodiversity of this hotspot is still incomplete. Recent examples are the recognition of a new species of

Tanyuromys, *T. thomasleei* (Timm et al. 2018), and a new genus *Pattonimus*, with two species, *P. ecominga* and *P. musseri* (Brito et al. 2020).

The highest concentration of species, especially rodents (ca. 30 species), with restricted distributions on the continent has been reported in the forests of the Chocó and the Andes of Ecuador (Maestri and Patterson 2016). Unfortunately, this high species diversity, along with ecosystems and their services, is threatened by accelerated changes in land use, pollution, and climate

change (Jarrín-V 2001; Cuesta et al. 2017; Kleemann et al. 2022).

Due to the rapid conversion of natural habitat, it is crucial to carry out inventories in order to catalog the species in each political jurisdiction (local, provincial, national, and regional) as well as determine their systematic identification, geographic distribution, and ecological function. This information is fragmentary, incomplete, and outdated in most countries of the world (Bauni et al. 2021). Ecuador is no exception; despite being one of the countries with the smallest territories in South America, there are still numerous areas with information gaps (Kleemann et al. 2022). This lack of information is evident in the Province of Imbabura. Although the diversity of mammals has been reported on since 1860 (Tomes 1860), there have been few inventories (Lee et al. 2010), and other limited reports (Thomas 1899; Thomas 1913; Timm et al. 2018; Brito et al. 2020).

Therefore, we present the results of an inventory of small non-volant mammals conducted in Lita, a forested area in northwestern Imbabura Province, Ecuador. We report latitudinal and elevational range extensions for *Pattonimus musseri* Brito, Koch, Percequillo, Tinoco, Weksler, Pinto & Pardiñas, 2020 and discuss the importance of continuing the inventory of diversity in Ecuador to fill information gaps.

Study Area

This study was conducted in seven localities of Lita, Imbabura province (Fig. 1; Table 1). In an elevational

range between 1,100 m alt. ($00^{\circ}47'44''N$, $078^{\circ}19'03''W$) and 1,931 m alt. ($00^{\circ}44'24''N$, $078^{\circ}18'35''W$). The area has remnants of humid subtropical forests which have been undergone anthropogenic disturbance, such as by the cultivation of *Furcraea andina* and large pastures.

Methods

The inventory of small mammals was carried out between March and August 2020 and 2021. Live traps (35 Sherman and 5 Tomahawk) were used for the capture of animals along a transect of approximately 180 m, divided into eight stations, with 4 or 5 traps per station. To increase capture effectiveness, a pitfall trap system was used at each location. This consisted of a line with six buckets (20 L capacity), buried at ground level bisected by a plastic barrier approximately 60 m long and 0.5 m high (Brito et al. 2020). All traps were set for three consecutive nights and checked each morning. Between the two methods a total of 2,724 traps/night were accumulated (Table 1). Both Sherman, Tomahawk, and pitfall traps were baited with a mixture of oatmeal, vanilla extract, peanut butter, and clove essence. For the handling and care of the specimens, the recommendations of Sikes et al. (2016) were followed.

The collected specimens were deposited in the mammal collection of the Instituto Nacional de Biodiversidad (MECN), Quito, Ecuador. The following research permits granted by the Ministerio del Ambiente de Ecuador: N. 011-2020 IC-FAU-FLO-DZI/MAAE; N. MAEE-DZI-OTI-UBVS-GM-2021-046; N. MAEE-DZI-OTI-UBVS-

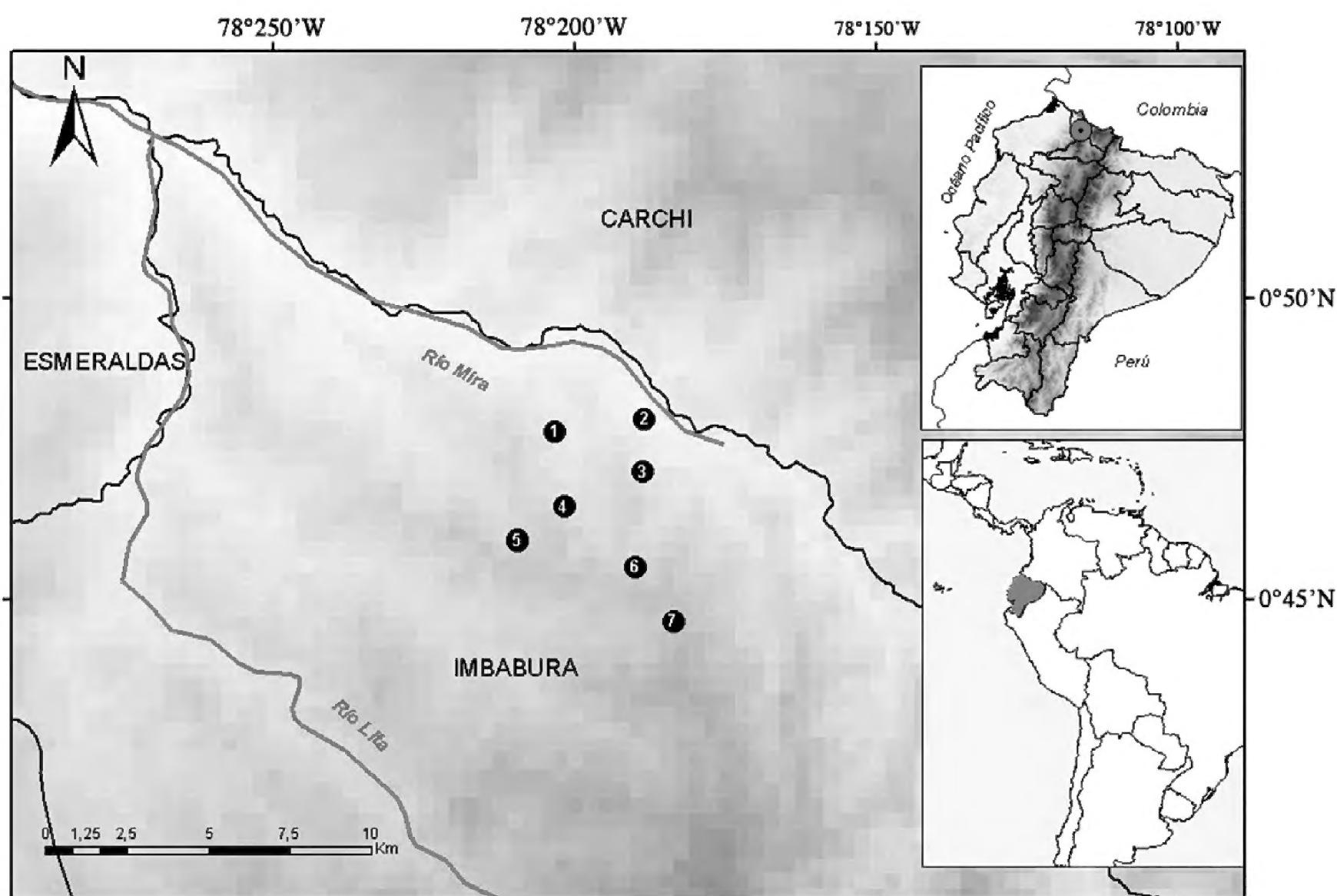


Figure 1. Study area in northwestern Imbabura: 1 = Alpala, 2 = Rocafuerte, 3 = Santa Cecilia, 4 = El Carmen, 5 = Aguinaga, 6 = Parambas, 7 = Urbina.

Table 1. Details of the study localities in northwestern Imbabura, Ecuador.

Locality	Traps/nights (live capture)	Traps/nights (pitfall)	Coordinates	Elevation (m)
1. Alpala	480	72	00°45'18"N, 078°19'13"W	1812
2. Rocafuerte	360	54	00°47'44"N, 078°19'03"W	1100
3. Santa Cecilia	180	36	00°46'17"N, 078°20'24"W	1550
4. El Carmen	240	36	00°45'45"N, 078°21'10"W	1700
5. Aguinaga	720	54	00°46'52"N, 078°19'05"W	1400–1600
6. Parambas	180	36	00°47'32"N, 078°20'32"W	1500
7. Urbina	240	36	00°44'24"N, 078°18'35"W	1931
Total	2,400	324		

GM-2021-047; N. MAEE-DZI-OTI-UBVS-GM-2021-04.

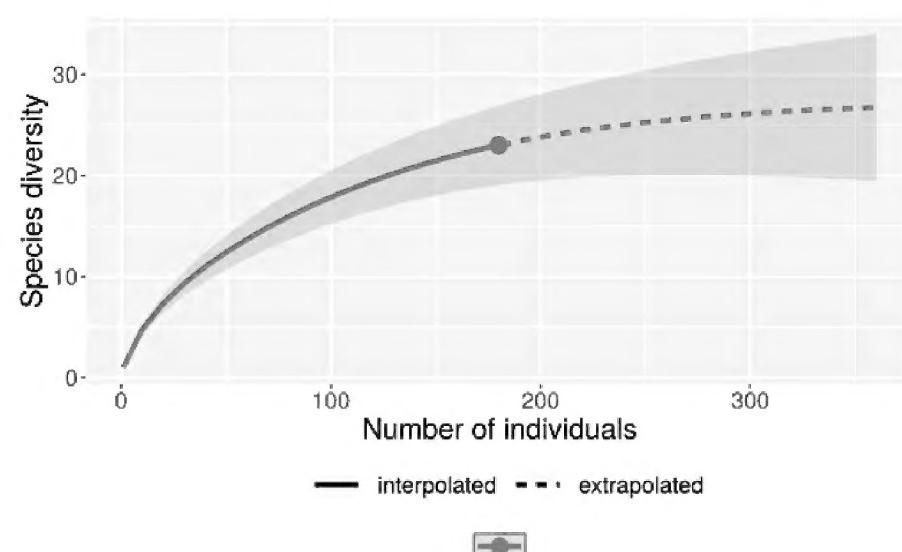
Taxonomic identification of our specimens was performed based on Patton et al. (2015), Pardiñas et al. (2017), and several specialized literature sources (Timm et al. 2018; Voss et al. 2014; Brito et al. 2020, 2022a), and in all cases they were compared with museum specimens. The characters used for species identification were based on our collected and observed material, as well as on the available literature. For the taxonomic listing we relied on Burgin et al. (2018), Burgin et al. (2020), and Abreu-Jr et al. (2020), and for common names in Spanish we followed Tirira et al. (2021). Finally, for conservation status at the global level we followed the IUCN (2021), and at the national level we followed Tirira (2021).

To obtain rarefaction and extrapolation curves, we used the sample coverage estimator developed by Chao and Jost (2012), implemented in iNext software (Chao et al. 2016; available at <https://chao.shinyapps.io/iNEXTOnline/>) and based on 40 knots with a 95% confidence interval set at 100 bootstrap resampling repetitions.

Results

The list of species is based on the animals collected and observed. A total of 180 individuals were captured at the seven localities, of which 104 were collected. In total we recorded 23 species of small mammals belonging to three orders: Rodentia (17 spp.; 73.9%), Didelphimorphia (5 spp.; 21.7%) and Eulipotyphla (1 spp.; 4.3%). Among the rodents, the family Cricetidae was the best represented, with 14 species representing 60% of the total richness.

Melanomys caliginosus (Tomes, 1860) was the most abundant species ($n = 99$), followed by *Nephelomys* sp. ($n = 17$). “*Handleymys*” *alfaroi* (J.A. Allen, 1891), and *Nephelomys moerex* (Thomas, 1914) were also relatively abundant species ($n = 13$ each), while other species were found in lower abundance (Table 2). Rarefaction and extrapolation curves indicate an approximation of a plateau in species diversity around 190 individuals captured (Fig. 2). The sample from Lita has a completeness or sample coverage of 95%. Sample coverage is the proportion of the community’s population that belongs to species detected by the sample (Chao and Jost 2012).

**Figure 2.** Rarefaction and extrapolation curves performed by the online software iNEXT (Chao et al. 2016), based on the number of individuals captured in the Lita area, Imbabura Province.

Four species are endemic to the northwestern forests of Ecuador (Table 2), including Musser’s Mountain Rat, *Pattonimus musseri*, a recently described species known only from Manduriacu in southern Imbabura province (Brito et al. 2020). In terms of conservation status, 39% of the species face some survival threat, including the western dwarf squirrel *Microsciurus mimulus* (Thomas 1898), which according to the Red List of mammals of Ecuador (Tirira 2021) is categorized as Endangered (Table 2).

Orden Didelphimorphia
Family Didelphidae

Caluromys derbianus (Waterhouse, 1841)

Material examined. ECUADOR – Imbabura • Lita, Rocafuerte; 00°47'44"N, 078°19'3"W, 1130 m alt.; 12.III.2021; D. Mantilla obs.; 1 sex indet. Parambas; 00°47'32"N, 078°20'32"W, 1500 m alt.; 21.VIII.2021; J. Curay, D. Jordán obs.; 2 sex indet.

Identification. Dorsal coat reddish brown, ventral color yellowish white. Head light gray, with a dark brown stripe in central of face (Fig. 3A). Ears hairless. Prehensile tail 30–50% woolly at its base, while tip of tail bare and whitish.

Didelphis marsupialis Linnaeus, 1758

Material examined. ECUADOR – Imbabura • Lita, Rocafuerte; 00°47'44"N, 078°19'03"W, 1130 m alt.; 12.III.2021; D. Mantilla obs.; captured with Tomahawk trap; 1 ♂.

Identification. Dorsum with pale yellow hairs interspersed with black hairs. Ears large and black (Fig. 3B). Tail naked, black at its base and white at its tip.

Marmosa phaea Thomas, 1899

Material examined. ECUADOR – Imbabura • Lita, El Carmen; 00°45'45"N, 078°21'10"W, 1700 m alt.; 11.III.2021; D. Mantilla leg; collected with pitfall trap; 1 ♀, MECN 6549.

Identification. Fur dense and short (12 mm). Dorsal color brown and ventral color cream-orange. Faint black

Table 2. Richness and abundance of non-volant mammals recorded in northwestern Imbabura. Abbreviations: DD = Data Deficient, LC = Least Concern, EN = Endangered, VU = Vulnerable, NE = Not Evaluated, NT = Near Threatened. 1 = Alpala, 2 = Rocafuerte, 3 = Santa Cecilia, 4 = El Carmen, 5 = Aguinaga, 6 = Parambas, 7 = Urbina. * = endemic species.

Order, family, species	Spanish common name	Abundance							Conservation		
		1	2	3	4	5	6	7	IUCN (2021)	Tirira (2021)	
DIDELPHIMORPHIA											
Didelphidae											
<i>Caluromys derbianus</i> (Waterhouse, 1841)	Zarigüeya lanuda de Derby	—	1	—	—	—	2	—	LC	VU	
<i>Didelphis marsupialis</i> Linnaeus, 1758	Zarigüeya común de orejas negras	—	1	—	—	—	—	—	LC	LC	
<i>Marmosa phaea</i> Thomas, 1899	Marmosa lanuda pequeña	1	—	—	1	—	—	—	VU	VU	
<i>Marmosops caucae</i> (Thomas, 1900)	Marmosa esbelta del Cauca	—	—	—	1	1	—	—	LC	LC	
<i>Philander melanurus</i> (Thomas, 1899)	Zarigüeya de cuatro ojos de cola oscura	1	—	—	—	—	—	—	LC	LC	
RODENTIA											
Sciuridae											
<i>Microsciurus mimulus</i> (Thomas, 1898)	Ardilla enana de occidente	—	—	1	1	—	—	—	LC	EN	
<i>Syntheosciurus granatensis</i> (Humboldt, 1811)	Ardilla de cola roja	—	1	—	—	—	1	—	LC	LC	
Heteromyidae											
<i>Heteromys australis</i> Thomas, 1901	Ratón bolsero austral	—	—	—	—	—	—	1	LC	VU	
Cricetidae											
<i>Chilomys weksleri</i> Brito, García, Pinto & Pardiñas, 2022	Ratón del bosque de Weksler	—	—	1	1	—	—	2	LC	DD	
" <i>Handleymys</i> " <i>alfaroi</i> (J.A. Allen, 1891)	Ratón de Alfaro	7	2	—	—	4	—	—	LC	LC	
<i>Melanomys caliginosus</i> (Tomes, 1860)	Ratón moreno	27	—	21	15	25	2	9	LC	NT	
<i>Microryzomys altissimus</i> (Osgood, 1933)	Ratón colilargo de páramo	1	—	—	—	—	—	—	LC	LC	
<i>Microryzomys minutus</i> (Tomes, 1860)	Ratón colilargo montano	2	—	2	2	—	—	—	LC	LC	
<i>Neacomys tenuipes</i> Thomas, 1900	Ratón cerdoso de pies delgados	—	—	—	—	1	—	—	LC	VU	
* <i>Nephelomys moerex</i> (Thomas, 1914)	Rata de bosque nublado de vientre gris	9	—	2	1	1	—	—	NE	VU	
<i>Nephelomys</i> sp.	Rata de bosque nublado	9	1	1	4	—	—	2	NE	NE	
<i>Oecomys bicolor</i> (Tomes, 1860)	Rata arborícola de vientre blanco	—	1	—	—	—	2	—	LC	LC	
* <i>Pattonimus musseri</i> Brito, Koch, Percequillo, Tinoco, Weksler, Pinto & Pardiñas, 2020	Rata montana de Musser	2	—	—	—	—	—	—	NE	VU	
<i>Rhipidomys</i> sp.	Rata trepadora	1	—	—	—	—	—	—	NE	NE	
<i>Rhipidomys latimanus</i> (Tomes, 1860)	Rata trepadora de pies anchos	—	—	1	—	1	—	—	LC	LC	
<i>Sigmodontomys alfari</i> J.A. Allen, 1897	Rata de agua de Alfaro	—	1	—	—	—	—	—	LC	VU	
* <i>Tanyuromys thomasleei</i> Timm, Pine & Hanson, 2018	Rata montana de cola larga de Thomas Lee	—	—	—	1	—	—	—	NE	VU	
EULIPOTYPHLA											
Soricidae											
* <i>Cryptotis equatoris</i> (Thomas, 1912)	Musaraña ecuatoriana negruzca	1	—	—	1	—	—	—	LC	NT	
Total		61	8	29	28	33	7	14			

orbital spots. Tail long (141% of the head–body length), naked, and brown, with small white spots at its tip. Skull with sparsely developed crest (Thomas 1899; Voss et al. 2014), postorbital processes well developed, a complete lingual cingulum on P2, and long postprotocristae (Voss and Giarla 2021).

Marmosops caucae (Thomas, 1900)

Material examined. ECUADOR – Imbabura • Lita, El Carmen; 00°45'45"N, 078°21'10"W, 1700 m alt.; 11.III.2021; D. Mantilla leg.; collected with pitfall trap; 1 ♀, MECN 6550.

Identification. Fur dense and short. Hair on back grayish brown (Fig. 3C). Ventral color yellowish white. Tail bare and bicolor. Skull without cranial baskets.

Philander melanurus (Thomas, 1899)

Material examined. ECUADOR – Imbabura • Lita, Alpala; 00°45'18"N, 078°19'13"W, 1819 m alt.; 11.III.2021; P. Salvador obs.; 1 sex indet.

Identification. Dorsum blackish gray from head to tail.

Head gray, with two whitish spots above eyes. Chin white. Phalanges of feet and hands pink (Fig. 3D).

Order Rodentia
Family Sciuridae

Microsciurus mimulus (Thomas, 1898)

Material examined. ECUADOR – Imbabura • Lita, Santa Cecilia; 00°46'17"N, 078°20'24"W, 1550 m alt.; 16.III.2021; J. Curay obs.; 1 sex indet. El Carmen; 00°45'45"N, 078°21'10"W, 1700 m alt.; 17.III.2021; D. Mantilla obs.; 1 sex indet.

Identification. Back and ventral color brown, with orange hair tips. Ears short. Tail not longer than body and not very bulky (Fig. 4A). Venter not sharply distinct from dorsum, orange to pale yellow (Eisenberg and Redford 1999).

Syntheosciurus granatensis (Humboldt, 1811)

Material examined. ECUADOR – Imbabura • Lita, Rocafuerte; 00°47'44"N, 078°19'03"W, 1130 m alt.; 11.III.2021; by D. Mantilla obs.; 1 sex indet. Parambas;



Figure 3. Small non-flying mammals from Lita, northwestern Imbabura. **A.** *Caluromys derbianus*. **B.** *Didelphis marsupialis*. **C.** *Marmosops caucae* (MECN 6550). **D.** *Philander melanurus*.

00°47'32"N, 078°20'32"W, 1500 m alt.; 24 March 2021; by J. Curay obs.; 1 sex indet.

Identification. Only large squirrel in northwestern Ecuador. Back and belly reddish, interspersed with brown. Tail thick, bulging, ochraceous proximally and blackish at tip. Feet and hands red or orange.

Family Heteromyidae

Heteromys australis Thomas, 1901

Material examined. ECUADOR – Imbabura • Lita, Urbina; 00°44'24"N, 078°18'35"W, 1931 m alt.; 04.IX.2021; by D. Jordan leg.; collected with pitfall trap; 1 ♂, MECN 6603.

Identification. Medium-sized, head–body length 128 mm. Coat dense, rough, with intermingled spines (Fig. 4B). Back glossy black. Belly whitish in clear contrast with back. Pocket on the cheeks present. Tail bicolor (dark on back and whitish ventrally) and shorter than body. Skull with interorbital region marked by a small ridge; incisor foramen short; braincase wide and distinctly inflated (Anderson and Jarrín-V 2002).

Family Cricetidae

Chilomys weksleri Brito, García, Pinto & Pardiñas, 2022

Material examined. ECUADOR – Imbabura • Lita, El Carmen; 00°45'45"N, 078°21'10"W, 1700 m alt.; 11.

III.2021; D. Mantilla leg.; collected with pitfall trap; 1 ♂, MECN 6546. Santa Cecilia; 00°46'17"N, 078°20'24"W, 1550 m alt.; 16.III.2021; J. Curay leg.; collected with pitfall trap; 1 ♀, MECN 6537). Urbina; 00°44'24"N, 078°18'35"W, 1931 m alt.; 4.IX.2021; D. Jordan leg; collected with pitfall trap; 1 ♂, 1 ♀, MECN 6602, 6605.

Identification. Small, head–body length 88–95 mm. Back dark gray and not contrasting with belly. Ears covered with small grayish hairs. Tail longer than head–body (128–136%), dark gray, and with 5 mm tip white. Cranial case inflated. Upper incisors prodont. Upper second molar (M2) with broader hypoflexus, similar in width to mesoflexus; lower first molar (m1) with anteromedian flexus (Brito et al. 2022a).

“*Handleymys*” *alfaroi* (J.A. Allen, 1891)

Material examined. ECUADOR – Imbabura • Lita, Rocafuerte; 00°47'44"N, 078°19'03"W, 1130 m alt.; 1.III.2021; by D. Mantilla leg.; collected with Sherman and pitfall trap; 3 ♂, MECN 6559, 6577–78. Aguinaga; 00°46'52"N, 078°19'05"W, 1600 alt.; 1.III.2021; D. Mantilla, S. Erazo leg.; collected with Sherman and pitfall trap; 3 ♂, 2 ♀, MECN 6569, 6575–76, 6598, 6601.

Identification. Small, head–body length 90–100 mm. Back dark brown, belly grayish white. Tail slender and slightly longer than head–body (101–109%), dark on back and slightly paler on ventral side. Skull with poorly developed lateral margins; incisive foramen short and wide.

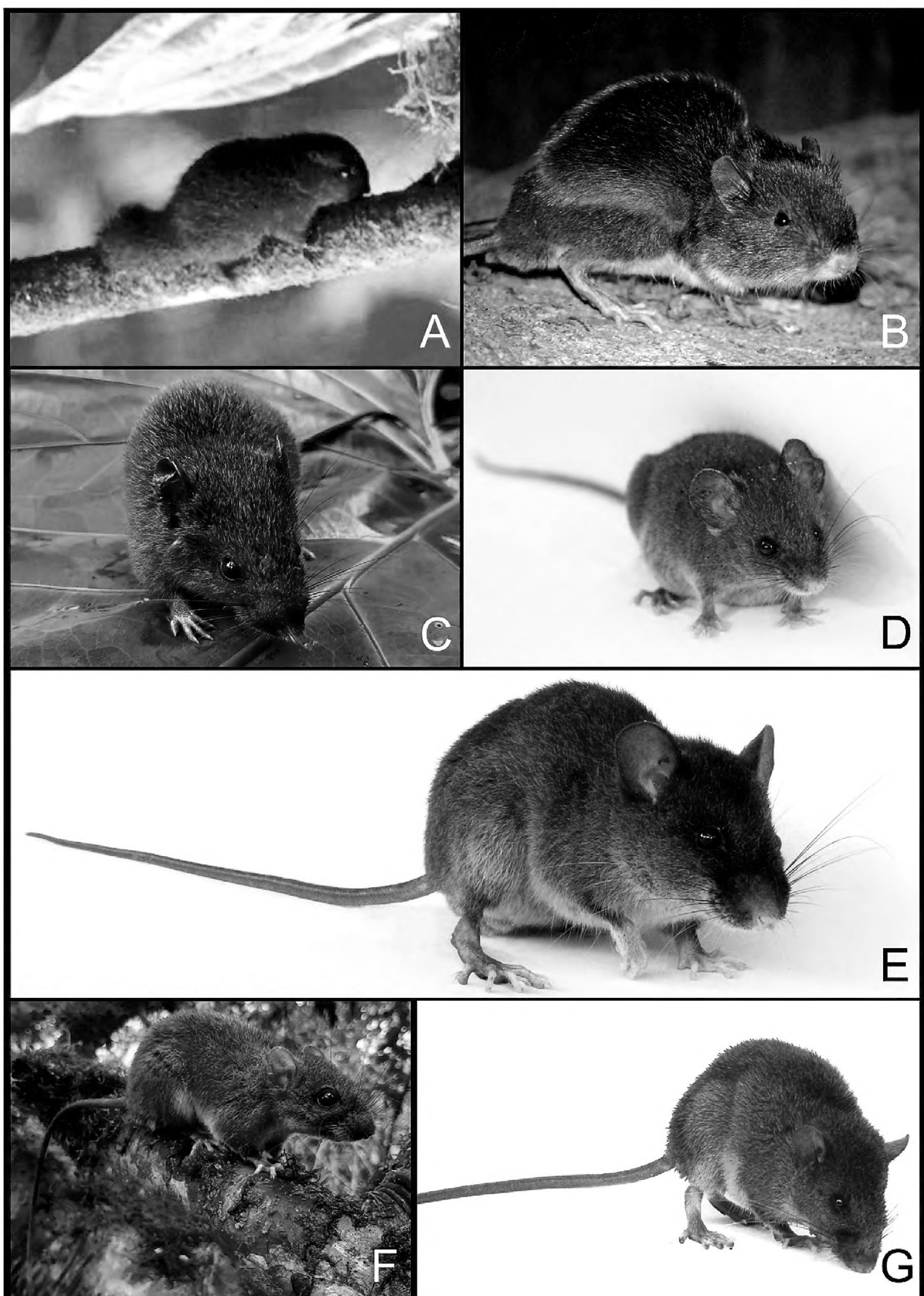


Figure 4. Small non-flying mammals from Lita, northwestern Imbabura. **A.** *Microsciurus mimulus*. **B.** *Heteromys australis* (MECN 6603). **C.** *Melanomys caliginosus* (MECN 6522). **D.** *Microryzomys minutus* (MECN 6526). **E.** *Nephelomys* sp. **F.** *Rhipidomys latimanus* MECN (6539). **G.** *Pattonimus musseri* (MECN 6190).

***Melanomys caliginosus* (Tomes, 1860)**

Material examined. ECUADOR – Imbabura • Lita, Alpala; 00°45'18"N, 078°19'13"W, 1819 m alt.; 10.III.2020; S. Erazo, J. Curay leg.; collected with Sherman and pitfall trap; 13 ♂, 3 ♀, MECN 6522; 6530; 6567; 6609–13; 6191–94; 6198–99; 6200–01. Aguinaga; 00°46'52"N, 78°19'05"W, 1409 m alt.; 31.VIII.2021; S. Erazo, J. Curay, D. Mantilla, D. Jordán leg.; collected with Sherman and pitfall trap; 7 ♂, 3 ♀, MECN 6540–43; 6571–74; 6597; 6600. Santa Cecilia; 00°46'17"N, 078°20'24"W, 1550 m alt.; 10–16.III.2021; J. Curay; collected with Sherman and pitfall trap; 4 ♂, 4 ♀, MECN 6533–36; 6579–82. El Carmen; 00°45'45"N, 078°21'10"W, 1700 m alt.; 25.VIII.2021; D. Mantilla, D. Jordan leg.; collected with Sherman and pitfall trap; 6 ♂, 2 ♀, MECN 6552–53; 6587–90; 6593–94.

Identification. Robust, small, head–body length 95–117 mm. Dorsal coat dark brown, with tips of hairs orange (Fig. 4C). Dorsal surface of legs and hands black and covered with dark hairs. Tail short in relation to body–head (91–92%). Skull with short incisor foramen, hourglass-shaped interorbital region, and presence of ridges.

***Microryzomys altissimus* (Osgood, 1933)**

Material examined. ECUADOR – Imbabura • Lita, Alpala; 00°45'18"N, 078°19'13"W, 1819 m alt.; 10.III.2021; J. Curay leg.; collected with Sherman and pitfall trap; 1 ♂, MECN 6525. Santa Cecilia; 00°46'17"N, 078°20'24"W, 1550 m alt.; 27.VIII.2021; J. Curay leg.; collected with pitfall trap; 2 ♂, MECN 6584–85.

Identification. Small, head–body length 84–90 mm. Dorsal coat olive-brown, and ventral color grayish cream. Tail slender and longer than body–head (141–162%), dorsally dark and ventrally lighter. Skull with long incisive foramen. Dentary with inconspicuous incisor tubercle (Carleton and Musser 1989).

***Microryzomys minutus* (Tomes, 1860)**

Material examined. ECUADOR – Imbabura • Lita, Alpala; 00°45'18"N, 078°19'13"W, 1819 m alt.; 10.III.2021; J. Curay leg.; collected with pitfall trap; 1 ♀, MECN 6526. El Carmen; 00°45'43"N, 078°21'10"W, 1700 m alt.; 25.VIII.2021; D. Mantilla, D. Jordan leg.; collected with pitfall trap; 2 ♂, MECN 6558; 6591.

Identification. Small, head–body length 74 mm. Dorsal coat yellowish brown and belly yellow or pale orange (Fig. 4D). Tail long compared to body–head (161%) and dark. Hind legs with protruding pads. Skull with long, wide incisor foramen. Dentary with distinct incisor tubercle (Carleton and Musser 1989).

***Neacomys tenuipes* Thomas, 1900**

Material examined. ECUADOR – Imbabura • Lita, Aguinaga; 00°46'52"N, 078°19'05"W, 1409 m alt.; 12.III.2020; S. Erazo leg.; collected with pitfall trap; 1 ♂, MECN 6570.

Identification. Only spiny rodent in the family Cricetidae in western Ecuador. Small, head–body length

74 mm. Coat rough, mixed with spines. Back orange-brown, interspersed with black hairs. Ventrally light cream-colored. Tail short in comparison to body–head (96%), unicolor, but with whitish hairs on ventral side. Cranial box inflated, with a small, oval incisive foramen.

***Nephelomys moerex* (Thomas, 1914)**

Material examined. ECUADOR – Imbabura • Lita, El Carmen 00°45'43"N, 078°21'10"W, 1700 m alt.; 11.III.2021; D. Mantilla leg.; collected with pitfall trap; 2 ♂, MECN 6555; 6557. Santa Cecilia; 00°46'17"N, 078°20'24"W 1550 m alt.; 27.VIII.2021; J. Curay leg.; collected with pitfall trap; 1 ♂, MECN 6586).

Identification. Medium-sized, head–body length 122–133 mm. Coat dense and short. Dorsal coat dark brown, ventrally whitish gray. Tail long in comparison head–body length (117–118%), dark on back and whitish ventrally. Skull with hourglass-shaped interorbital region, cranial crests slightly raised, and short, incisive foramen (Percequillo 2015).

***Oecomys bicolor* (Tomes, 1860)**

Material examined. ECUADOR – Imbabura • Lita, Rocafuerte; 00°47'44"N, 078°19'03"W, 1100 m alt.; 10.III.2021; D. Mantilla leg.; collected with pitfall trap; 1 ♀, MECN 6554) Parambas 00°47'32"N, 078°20'32"W, 1500 m alt.; 24.III.2021; J. Curay leg.; collected with pitfall trap; 2 ♀, MECN 6544; 6545.

Identification. Only species of the genus in western Ecuador. Small, head–body length 89 mm. Hair smooth and short. Back orange, with gray base. Belly whitish, with gray base, contrasting with back. Tail not so long in comparison head–body (144%), and with a small 0.5 mm brush at its tip. Skull small, incisive foramen short and thin.

***Pattonimus musseri* Brito, Koch, Percequillo, Tinoco, Weksler, Pinto & Pardiñas, 2020**

Material examined. ECUADOR – Imbabura • Lita, Alpala; 00°45'18"N, 078°19'13"W, 1819 m alt.; 07.VIII.2020–10.III.2021; J. Curay leg.; collected with Sherman and pitfall trap; 1 ♂, 1 ♀, MECN 6190; 6527.

Identification. Medium-sized, head–body length 146 mm. Fur dense and short. Back reddish brown (Fig. 4G) and belly pale orange. Tail conspicuously scaly, unicolored, and longer than body–head length (128%). Molar occlusal topography simplified and laminated, like that described by Brito et al. (2020), without mesoloph in M1–M2 (Fig. 5).

***Rhipidomys latimanus* (Tomes, 1860)**

Material examined. ECUADOR – Imbabura • Lita, Santa Cecilia; 00°46'17"N, 078°20'24"W, 1550 m alt.; 16.III.2021; J. Curay leg.; collected with Sherman trap; 1 ♂, MECN 6539. Aguinaga; 00°46'52"N, 078°19'05"W, 1409 m alt.; 17.III.2021; D. Mantilla leg.; collected with pitfall trap; 1 ♀, MECN 6548.

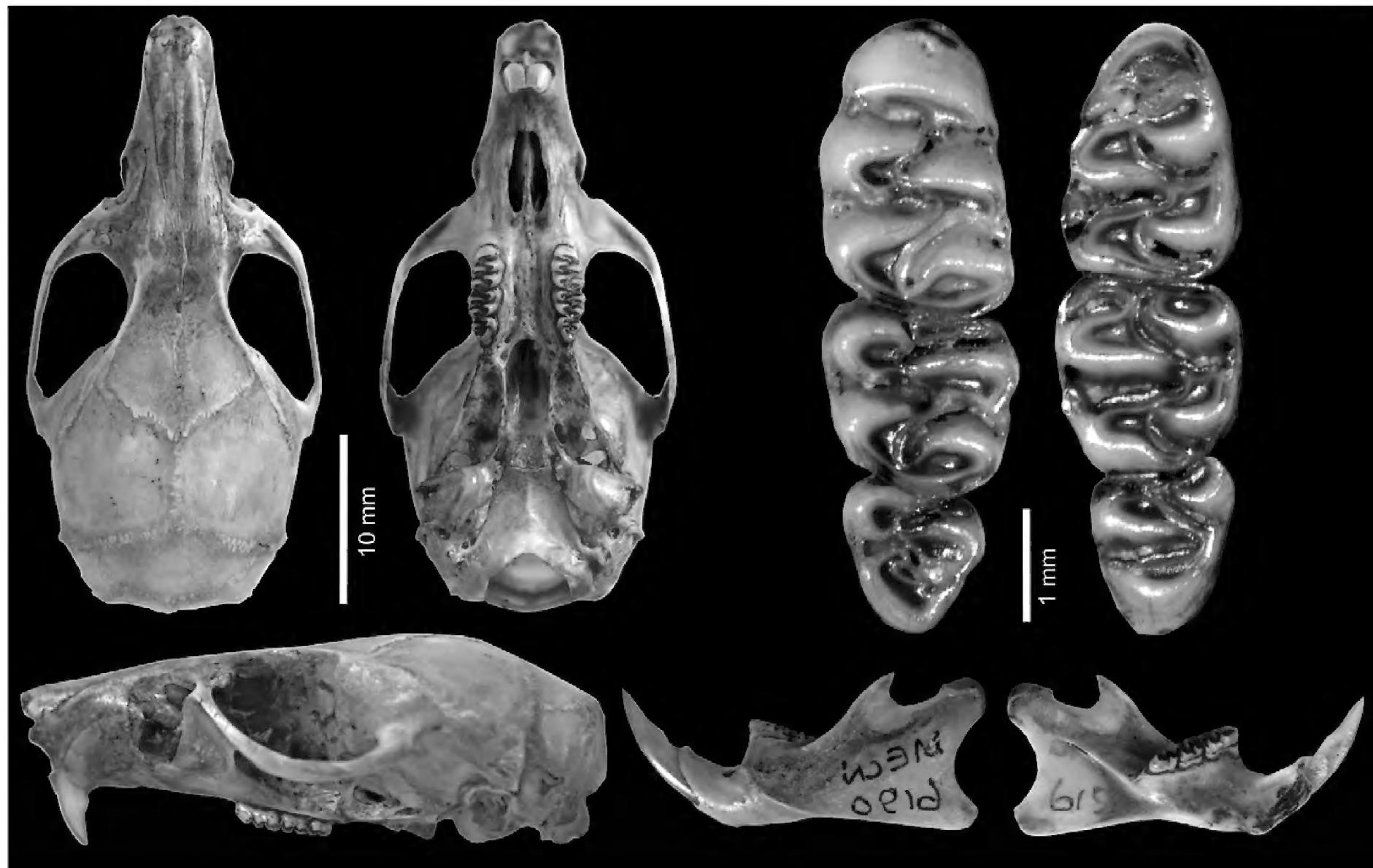


Figure 5. Skull (cranium in dorsal, ventral, and lateral and mandible in labial and lingual view) and right upper and left lower molar series of *Pattonomus musseri* (MECN 6190; Alpala, Lita Ecuador).

Identification. Medium-sized, head–body length 118–138 mm. Fur dense and short. Dorsum dark orange (Fig. 4F) and belly whitish cream. Protruding anus. Tail long, 121–142% of head–body, ending with a 12–17 mm bulging brush. Skull with broad and rounded interorbital region (Fig. 6A). Incisive foramen elongated, wide, and with small auditory bullae (Tribe 2015).

Sigmodontomys alfari J.A. Allen, 1897

Material examined. ECUADOR – Imbabura • Lita, Rocafuerte; 00°47'44"N, 078°19'03"W, 1100 m alt.; 16.III.2021; D. Mantilla leg.; collected with pitfall trap; 1 ♂, MECN 6547.

Identification. Medium size, head–body length 104 mm. Coat long and dense. Back dark brown, interspersed with ochre-colored hairs. Belly slightly paler than back. Tail long (103.8 mm) and uniformly dark. Hind legs long and broad. Skull medium and robust; nasals long. Incisive foramen short and wide (Fig. 6B). Molar morphology with an obvious tendency towards lophodonty (Brito et al. 2022b).

Tanyuromys thomasleei Timm, Pine & Hanson, 2018

Material examined. ECUADOR – Imbabura • Lita, El Carmen; 00°45'45"N, 078°21'10"W, 1700 m alt.; 11.III.2021; D. Mantilla leg.; collected with pitfall trap; 1 ♀, MECN 6551.

Identification. Medium-sized, head–body length 110 mm. Coat dense and long (13 mm). Back dark brown; ventral color like back, but slightly more grayish. Tail uniformly dark and much longer in comparison head–body

(147%). Molars lophodont (Fig. 6C), distinct among oryzomyines, with a complex folding pattern of flexus and flexids (Brito and Arguero 2016; Timm et al. 2018) and carotid circulatory pattern 3 (Weksler 2015; Brito et al. 2022b).

Order Eulipotyphla
Family Soricidae

Cryptotis equatoris (Thomas, 1912)

Material examined. ECUADOR – Imbabura • Lita, Alpala; 00°45'18"N, 078°19'13"W, 1819 m alt.; 11.III.2021; J. Curay leg.; 1 ♀, MECN 6528. El Carmen; 00°45'45"N, 078°21'10"W 1700 m alt.; 25.VIII.2021; D. Jordán leg.; collected with pitfall trap; 1 ♀, MECN 6592.

Identification. Small, head–body length 75–80 mm. Coat blackish dorsally and ventrally. Head elongated, with snout pointed. Eyes tiny and lack pinnae. Dentition reddish.

Discussion

Studies on the diversity of small non-volant mammals are scarce for northwestern Ecuador (Jarrín-V 2001; Bravo et al. 2003; Pozo et al. 2007; Lee et al. 2010; Curay et al. 2019; Lee et al. 2021). Among the areas with the highest diversity is Otonga in Cotopaxi province, where 26 species have been reported (Jarrín-V 2001; Lee et al. 2022), followed by two reserves located in Pichincha province, the Pululahua Geobotanical Reserve with 21 species (Curay et al. 2019) and the Guajalito River Ecological Reserve with 11 species (Bravo et al. 2003). However,

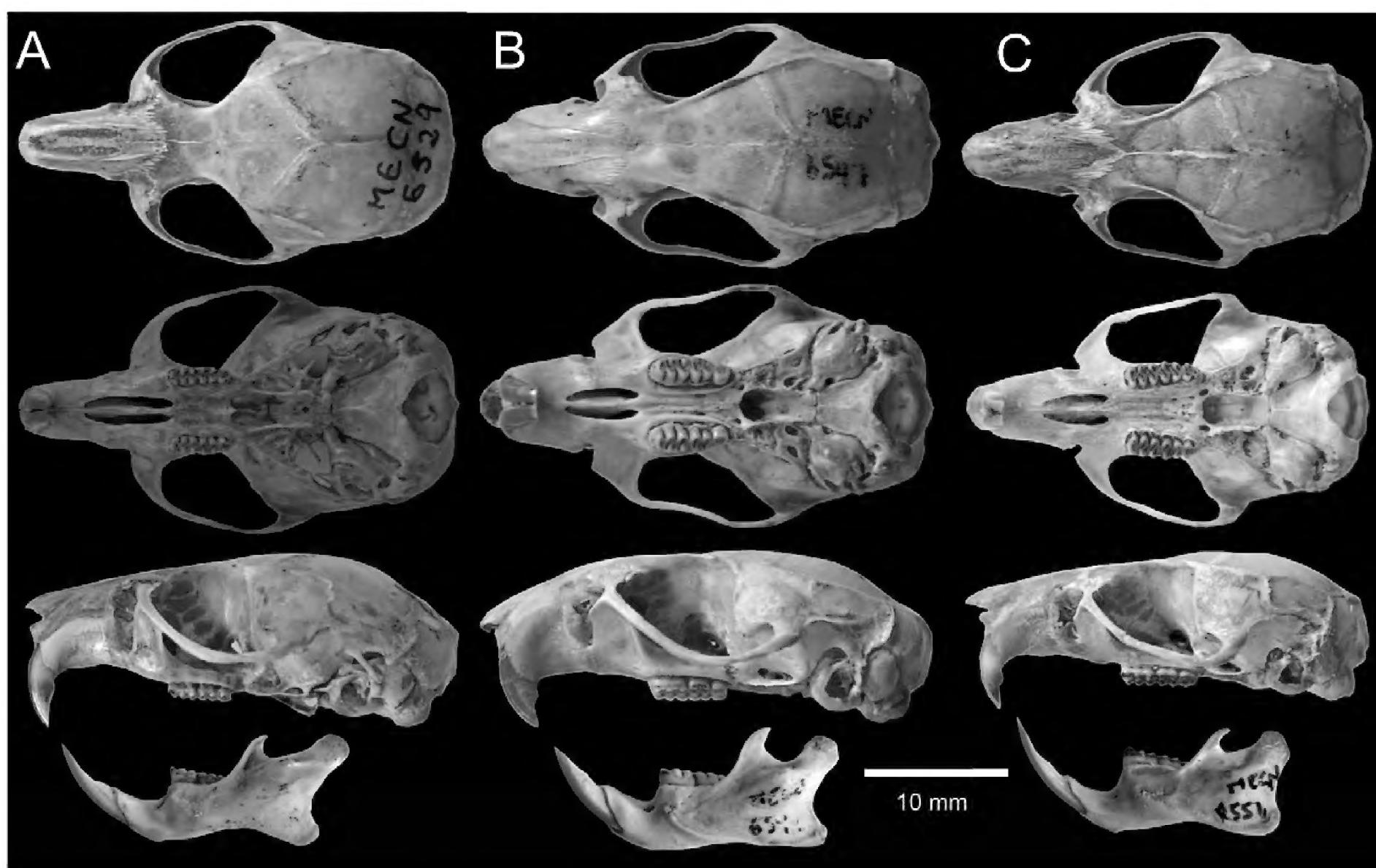


Figura 6. Skull (cranium in dorsal, ventral, and lateral and mandible). **A.** *Rhipidomys latimanus* (MECN 6529). **B.** *Sigmodontomys alfari* (MECN 6547). **C.** *Tanyuromys thomasleei* (MECN 6551).

only one inventory exists for the province of Imbabura; from Santa Rosa, eight species have been reported by Lee et al. (2010). In comparison, Lita, in Imbabura, has 23 species and is therefore the most diverse known locality in that province and the second most diverse locality in northwestern Ecuador.

Among the novel records we report is our record of the recently described *Pattonimus musseri*. Alpala, Lita is only the second known locality for this species and extends the latitudinal range by approximately 78 km from the type locality in the Manduriacu River Reserve (Brito et al. 2020). Alpala, at 1,812 m, is also higher than the type locality at 1,200 m, as reported in Brito et al. (2020).

Another species of special attention is *Oecomys bicolor*. Thomas (1900) described it as *O. dryas* from Parambas (we examined specimens from the type locality for comparison). This taxon is currently considered a synonym of *Oecomys bicolor*, which was described from Gualajiza on the southeastern slope of Ecuador. However, we believe that a systematic review of *Oecomys* in western Ecuador, including genetic, molecular, and morphological evidence, is needed to help elucidate the status of *O. dryas*. Similarly, a thorough review of *Rhipidomys* sp., and *Nephelomys* sp. (Table 2) is required. It is possible that they may belong to species from the Colombian Chocó or be undescribed.

The entire area of our study is forest remnants surrounded by pastures, agricultural areas, and mining concessions (Roy et al. 2018), yet the species richness of small mammals here is remarkable. However, the potential loss

of these ecosystems would put nine species, including one Endangered, near Vulnerable, and two Near Threatened species, at greater risk of extinction. Four of the species are endemic to northwestern Ecuador. This highlights the urgent need to establish comprehensive programs for inventories and biological collections, as well as to improve access to these resources for scholars. Additionally, the attention of regional and national authorities is required to join efforts to ensure conservation.

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Authors' Contributions

Conceptualization: JB, JC, DM. Data curation: JC, JB. Formal analysis: JC, JB. Investigation: DM. Writing – original draft: JB. Writing – review and editing: JC, DM.

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